

UNCLASSIFIED

~~CONFIDENTIAL~~

MOIST Project-2

INFORMAL  
MANUSCRIPT  
REPORT.

NO. ~~CONFIDENTIAL~~

LEVEL II

①

TITLE

OCEANOGRAPHY FOR SUBMARINE LONG RANGE SONAR IN ATLANTIC  
AREA J FOR JANUARY AND FEBRUARY

AD A0 66763

AUTHOR

①④ NOO-IM-8-113-63

OCEANOGRAPHIC DEVELOPMENT DIVISION

DATE

DDC FILE COF

①①  
DECEMBER 1963

①②  
43p.

DDC  
RECEIVED  
APR 2 1979  
F.

This manuscript has a limited distribution, therefore  
in citing it in a bibliography, the reference should be  
followed by the phrase UNPUBLISHED MANU-  
SCRIPT.

401 263  
DOWNGRADED AT 3 YEAR INTERVALS;  
DECLASSIFIED AFTER 12 YEARS.  
DOD DIR 5200.10

MARINE SCIENCES DEPARTMENT  
U. S. NAVAL OCEANOGRAPHIC OFFICE  
WASHINGTON, D. C. 20390

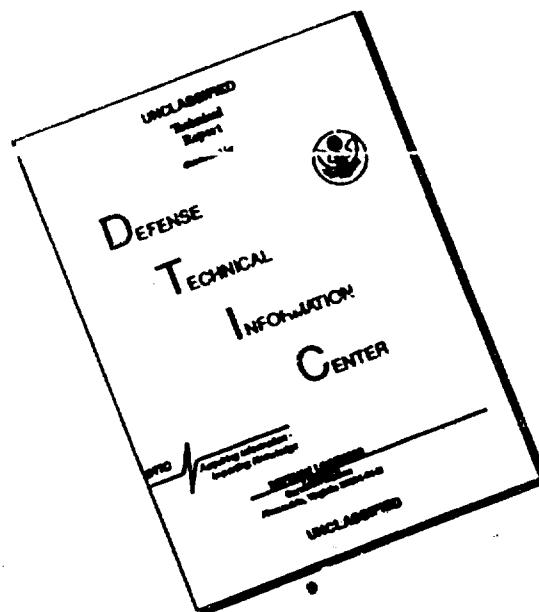
UNCLASSIFIED

~~CONFIDENTIAL~~

DISTRIBUTION STATEMENT A

Approved for public release;  
Distribution Unlimited

# DISCLAIMER NOTICE



THIS DOCUMENT IS BEST  
QUALITY AVAILABLE. THE COPY  
FURNISHED TO DTIC CONTAINED  
A SIGNIFICANT NUMBER OF  
PAGES WHICH DO NOT  
REPRODUCE LEGIBLY.

ABSTRACT

UNCLASSIFIED

~~CONFIDENTIAL~~

CONTENTS:

deg

min

→ 1. AREA: One-degree quadrangle 22° to 23°N, 69°45' to 70°45'W;

M<sup>2</sup> PREDICTED VALUES FOR QUADRANGLE FOR JANUARY THROUGH FEBRUARY, (SOURCE DEPTH = 150 FEET); CONT

Sound Speed at Sonar (150 feet)	5042 ft/sec
Layer Depth	262 ft
Layer Depth Sound Speed	5043 ft/sec

Convergence Zone (For a depth of approximately 3,000 fathoms, surface and bottom reflected mys are not considered)

Speed at Bottom (Fig 4)	5100 ft/sec
Minimum Refracted Angle (Fig 6)	-3° (down)
Maximum Refracted Angle (Fig 6)	-7° (down)
Average Angle	-5° (down)
Best Equipment Tilt (D/E) Angle	0°
Mean Horizontal Speed for Best Tilt (D/E) Angle (Fig 8)	4930 ft/sec
Initial Range (Fig 7) at the Surface (-7° down)	72.7 kyds
Reswept Surface Zone Width (Fig 2)	No Retracing Apparent

Bottom Bounce (For a depth of approximately 3,000 fathoms)

Minimum Useful Inclination Angle = Maximum Refracted Angle of Convergence +3° =	-10° (down)
Predicted Detection Range (Fig 7)	56.8 kyds
Mean Horizontal Speed (Fig 8)	4882 ft/sec

Near Surface Path Detection

12-knot Figure of Merit + Target Strength 215 db	
Range (Table 1)	37.5 kyds

ACCESSION No.	
NTS	White Section <input checked="" type="checkbox"/>
OC	Full Section <input type="checkbox"/>
UNANNOUNCED	<input type="checkbox"/>
JUSTIFICATION <i>PER Letter</i>	
<i>QM File</i>	
BY	
DISTRIBUTION/AVAILABILITY CODES	
Dist.	AVAIL and/or SPECIAL
<i>A</i>	

DDC  
RECEIVED  
APR 2 1979  
F

DISTRIBUTION STATEMENT A  
Approved for public release;  
Distribution Unlimited

UNCLASSIFIED

~~CONFIDENTIAL~~

0-113-63

UNCLASSIFIED

~~CONFIDENTIAL~~

Cont' X

I AREA: One-degree quadrangle 22° to 23°N, 69°45' to 70°45'W

II PREDICTED VALUES FOR QUADRANGLE FOR JANUARY THROUGH FEBRUARY  
(SOURCE DEPTH = 250 FEET)

Sound Speed at Sonar (250 feet)	5043 ft/sec
Layer Depth	262 ft
Layer Depth Sound Speed	5043 ft/sec

Convergence Zone (For a depth of approximately 3,000 fathoms,  
surface and bottom reflected rays are not considered)

Speed at Bottom (Fig 4)	5100 ft/sec
Minimum Refracted Angle (Fig 6)	-1° (down)
Maximum Refracted Angle (Fig 6)	-7° (down)
Average Angle	-4° (down)
Best Equipment Tilt (D/E) Angle	0°
Mean Horizontal Speed for Best Tilt (D/E) Angle (Fig 8a)	4931 ft/sec
Initial Range (Fig 7a) at the Surface (-7° down)	72.4 kys
Reswept Surface Zone Width (Fig 2a)	No Retracing Apparent

Bottom Bounce (For a depth of approximately 3,000 fathoms)

Minimum Useful Inclination Angle = Maximum Refracted Angle of Convergence +3° =	-10° (down)
Predicted Detection Range (Fig 7a)	55.8 kys
Mean Horizontal Speed (Fig 8a)	4878 ft/sec

Near Surface Path Detection

12-knot Figure of Merit + Target Strength 215 db Range (Table 1)	37.5 kys
---	----------

0-113-63

UNCLASSIFIED

~~CONFIDENTIAL~~

~~CONFIDENTIAL~~

CNT →

3-  
III

USE OF GRAPHS FOR PARTICULAR CONDITIONS

ABSTRACT

1. From BT temperature trace, determine and tabulate sound speed at sonar depth ( $V_1$ ) and at layer depth ( $V_2$ ) from Figure 5. Tabulate bottom ( $V_3$ ) from Figure 4.

2. Convergence zone

- a. Determine if convergence zone is possible. The difference between the bottom speed ( $V_3$ ) and speed at sonar depth ( $V_1$ ) will give a qualitative indication of convergence zone existence according to the table below.

$V_3 - V_1$ (ft/sec)	Convergence Zone Existence
Negative	None
0-30	Borderline
>30	Strong

- b. To determine angular width and midpoint of totally refracted rays usable in convergence zone:

- (1) Determine minimum angle for totally refracted ray from Figure 6 using sound speed at sonar depth ( $V_1$ ) and sound speed at layer depth ( $V_2$ ) (first vertexing speed). With no layer, the minimum angle is  $0^\circ$ .
- (2) Determine maximum angle for totally refracted ray from Figure 6 using sound speed at sonar depth and bottom sound speed ( $V_3$ ) (second vertexing speed) from Figure 4. (Bottom sound speed may also be obtained from sound speed profile in Figure 1).
- (3) Best tilt (D/E) angle for convergence zone will be that equipment tilt nearest the average of the minimum and maximum angles.

3. Bottom Bounce

- a. Refracted ray angle (to the nearest degree) tangent to the bottom [Item 2 b (2), above] plus  $3^\circ$  determines the minimum useful bottom bounce Ray angle.
- b. Use the equipment tilt (D/E) angle nearest to the minimum useful bottom bounce Ray angle as computed in Item III 3 a.

4. Near surface path detection range

- a. Use Table 1.

TABLE 1 MEAN SURFACE PATH DETECTION RANGE (KYDS)  
OF A SHALLOW TARGET

LAYER DEPTH (FEET)	FIGURE OF MERIT PLUS TARGET STRENGTH (ALLOWABLE TWO-WAY LOSS IN DB)										
	170	175	180	185	190	195	200	205	210	215	220
0	3	3	4	4	5	5	6	7	8	8	9
50	7	8	10	11	12	14	15	17	19	20	22
100	10	11	13	16	17	19	22	24	26	29	31
400	13	17	19	23	27	30	34	38	41	45	49

~~CONFIDENTIAL~~

CONFIDENTIAL

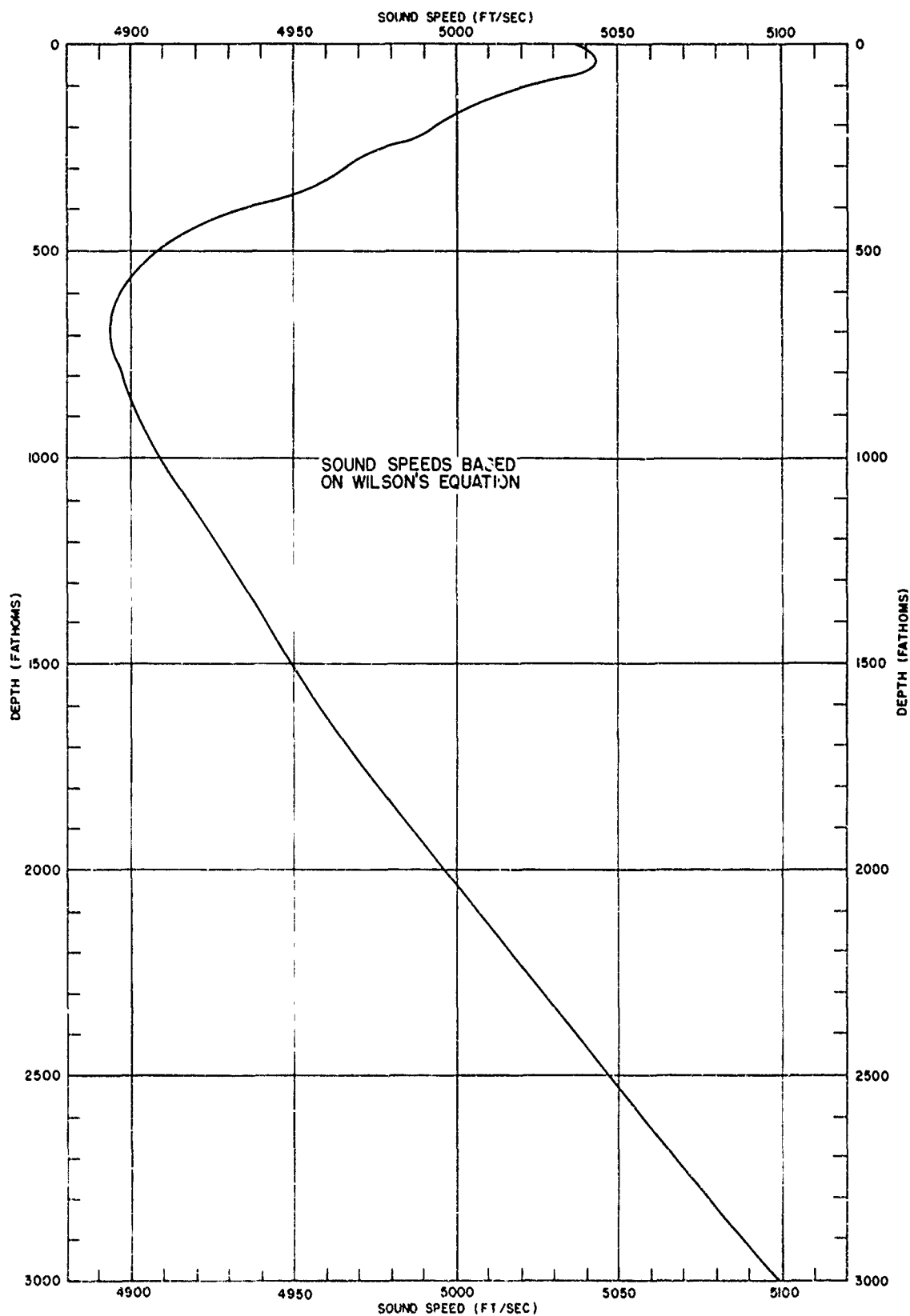


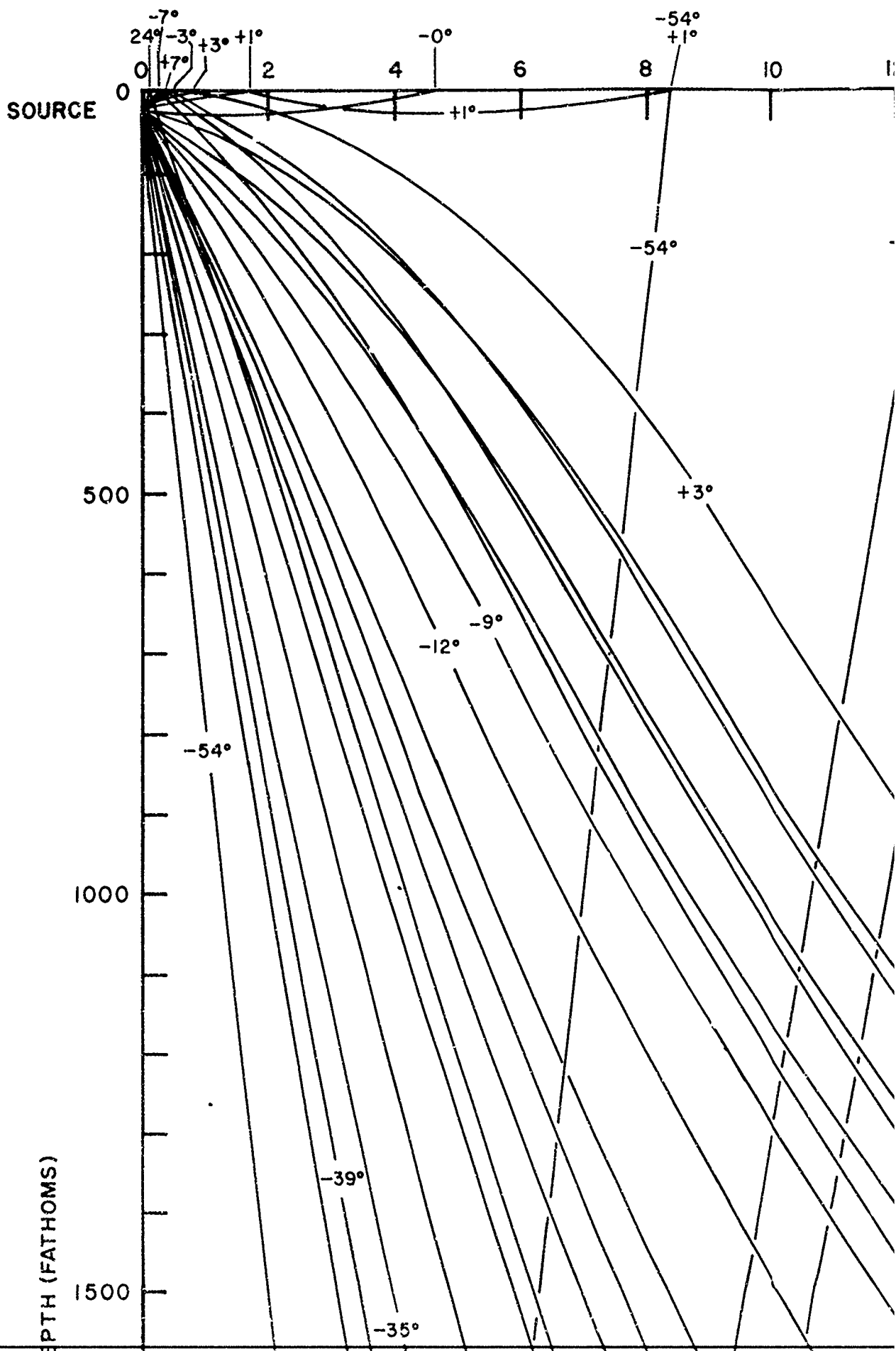
FIGURE I TYPICAL SOUND SPEED PROFILE FOR JANUARY THROUGH FEBRUARY

CONFIDENTIAL

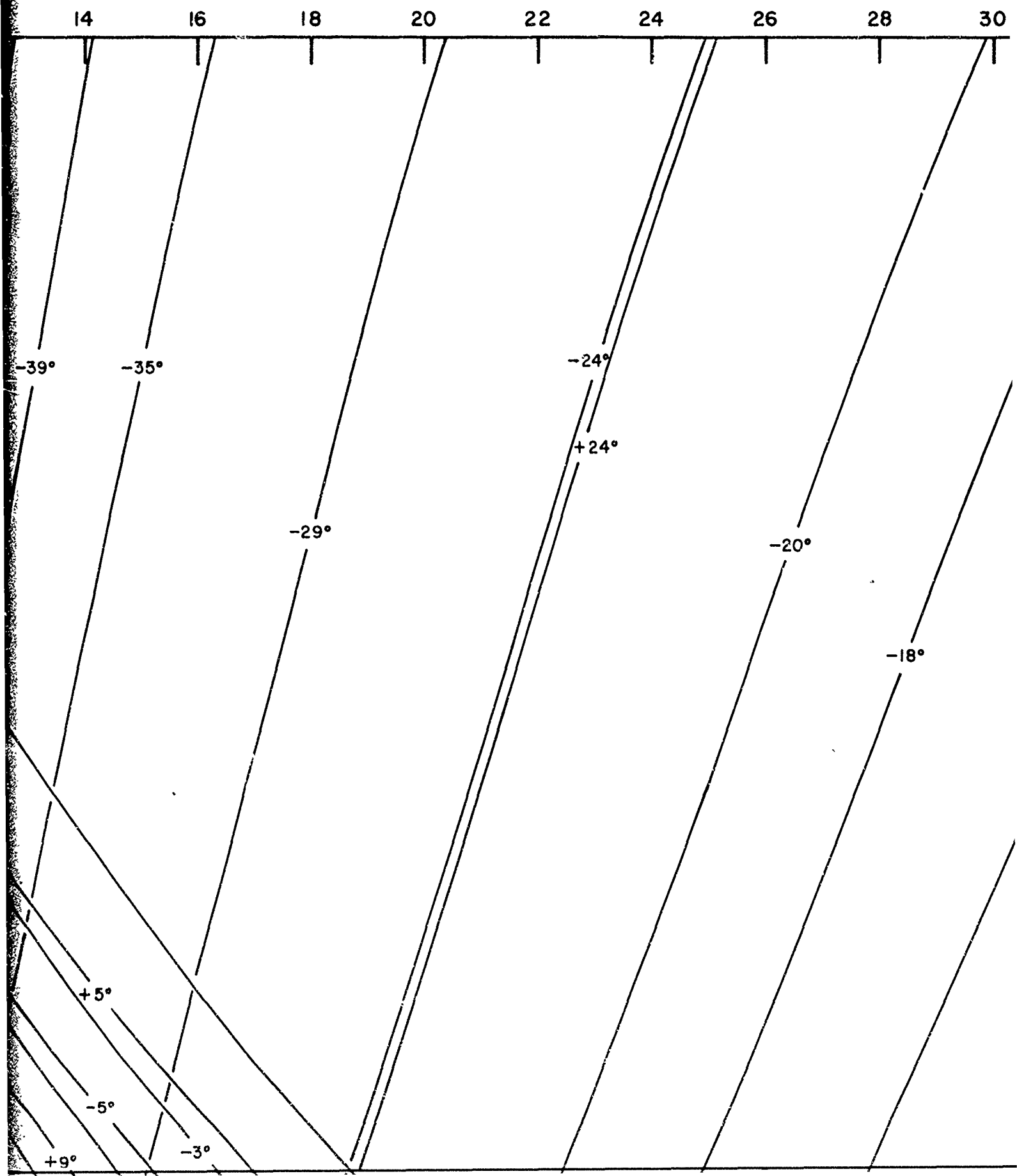
0-113-63

~~CONFIDENTIAL~~

A



2





3

RANGE (KILOYARDS)

32

34

36

38

40

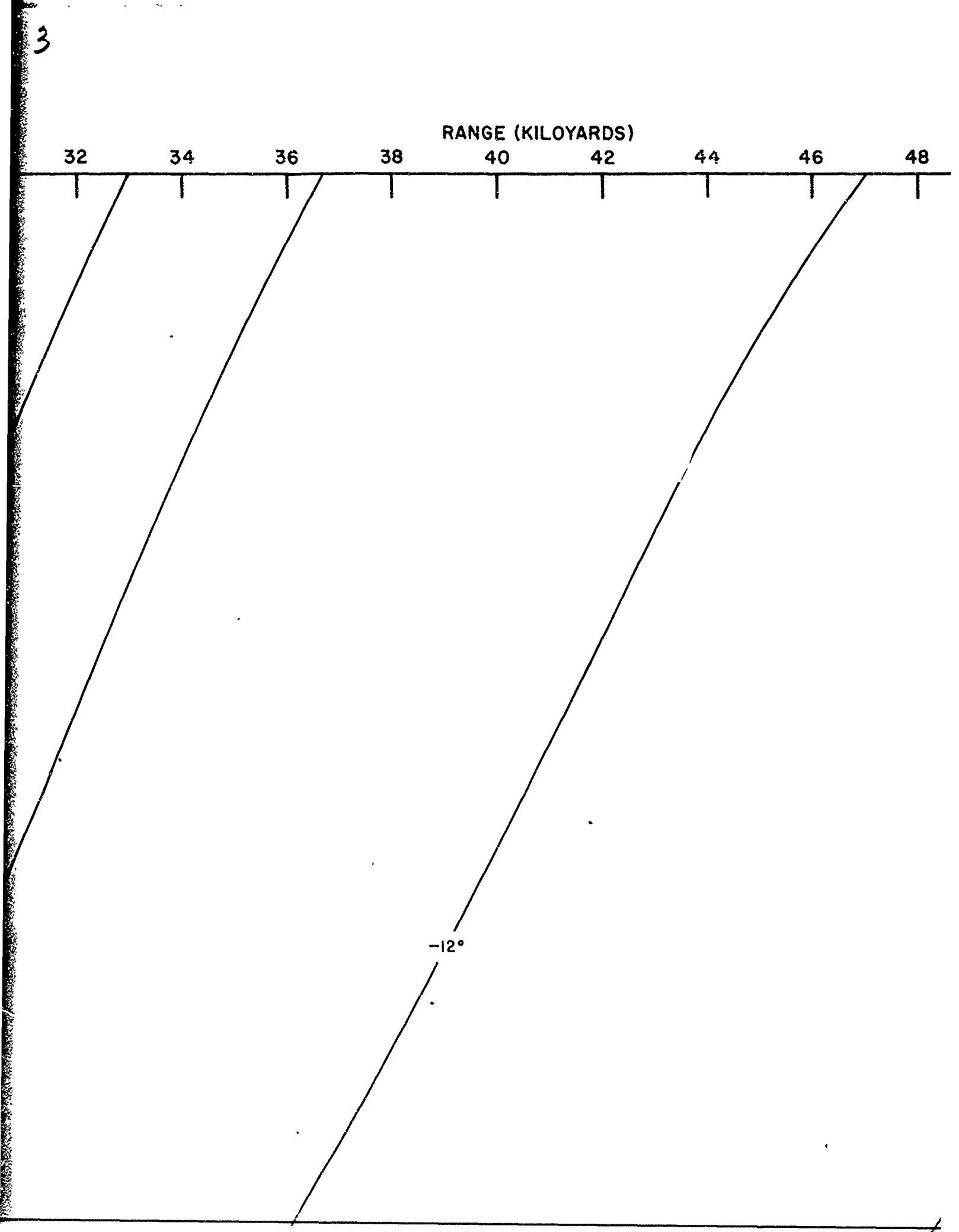
42

44

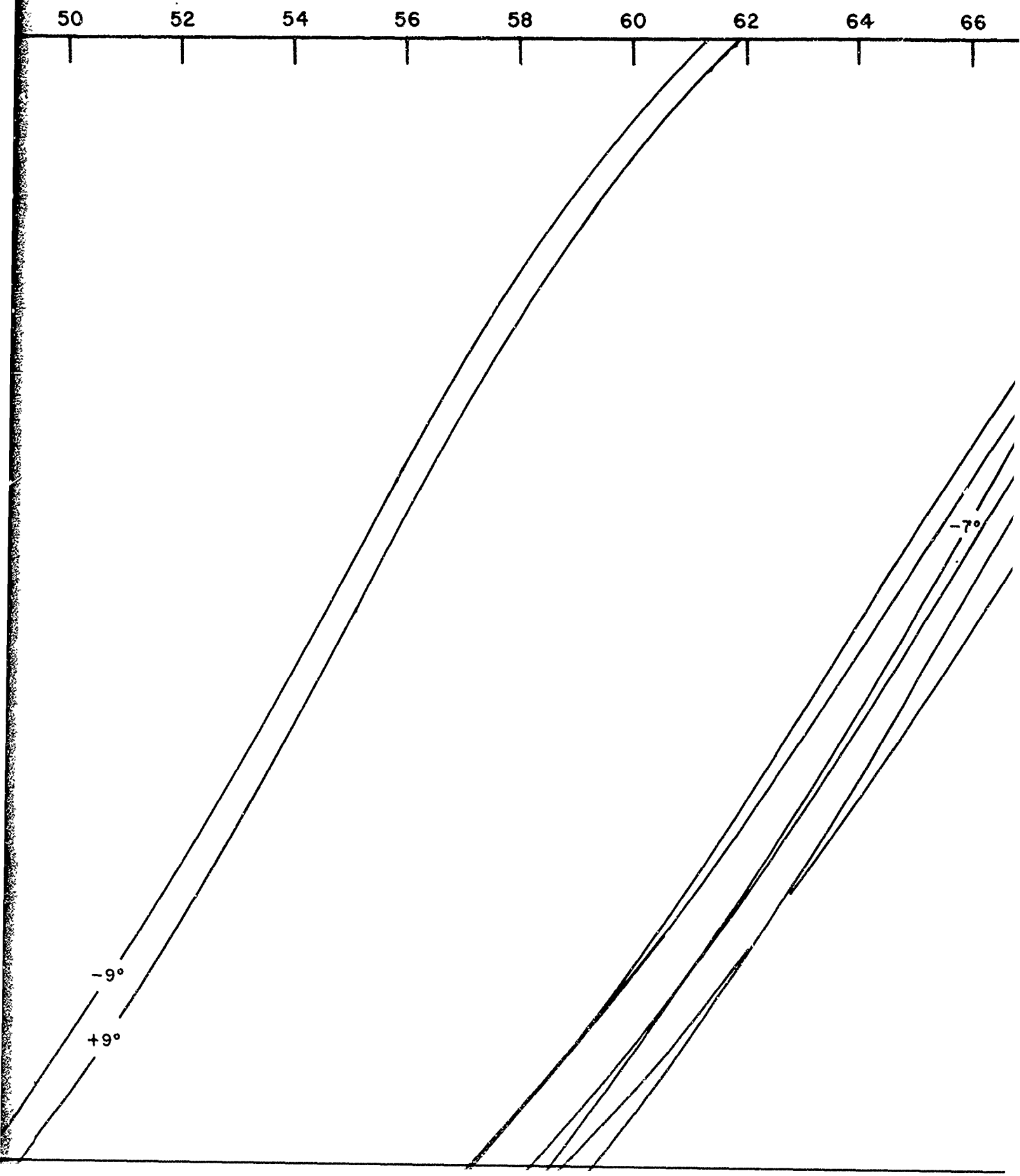
46

48

-12°



4



5

B

68 70 72  $-7^\circ$   $-5^\circ$   $+7^\circ$   $+5^\circ$   $-3^\circ$  74 76  $+3^\circ$  78 80 82

0

$-7^\circ$

$-5^\circ$

$-3^\circ$

$+7^\circ$

$+5^\circ$

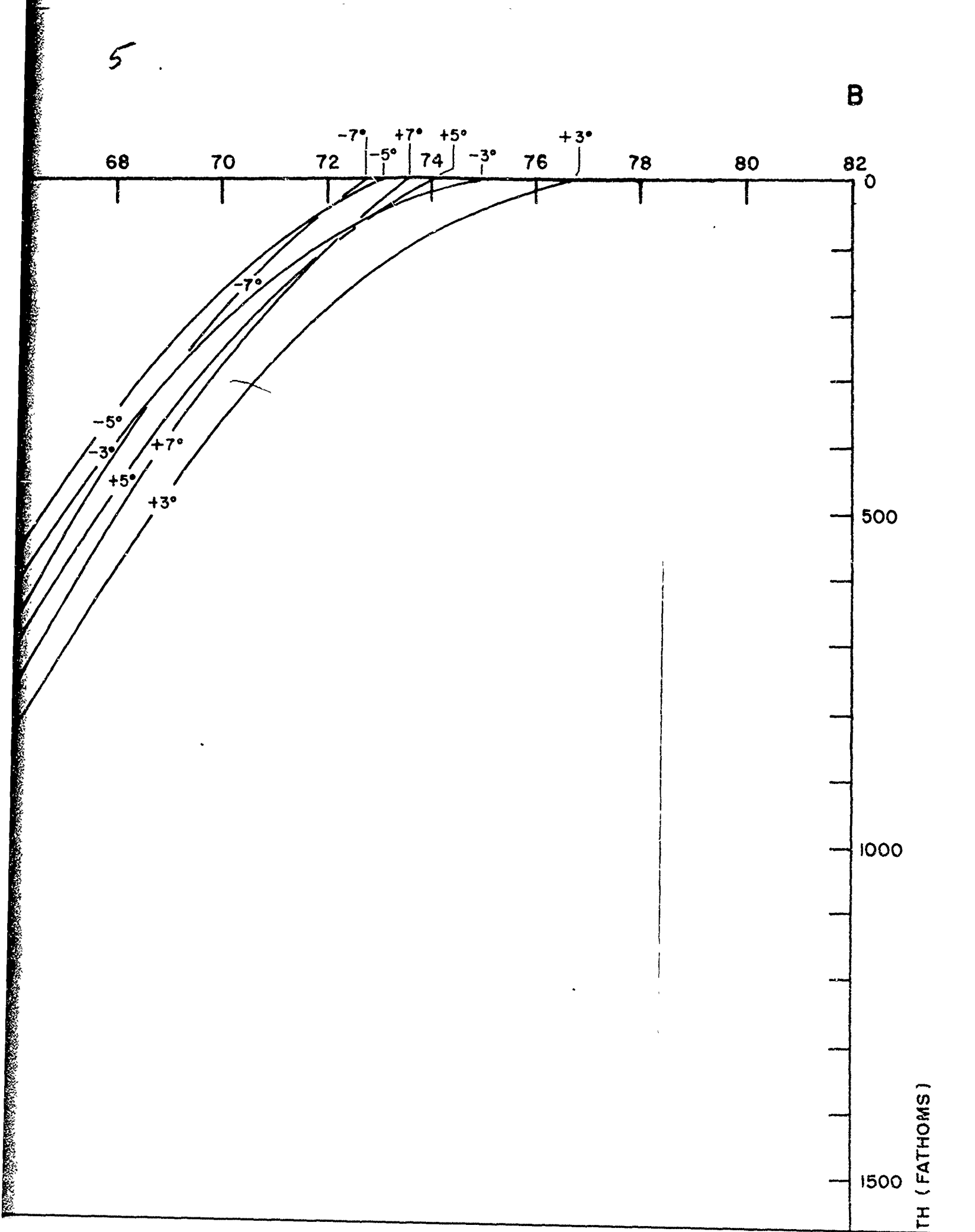
$+3^\circ$

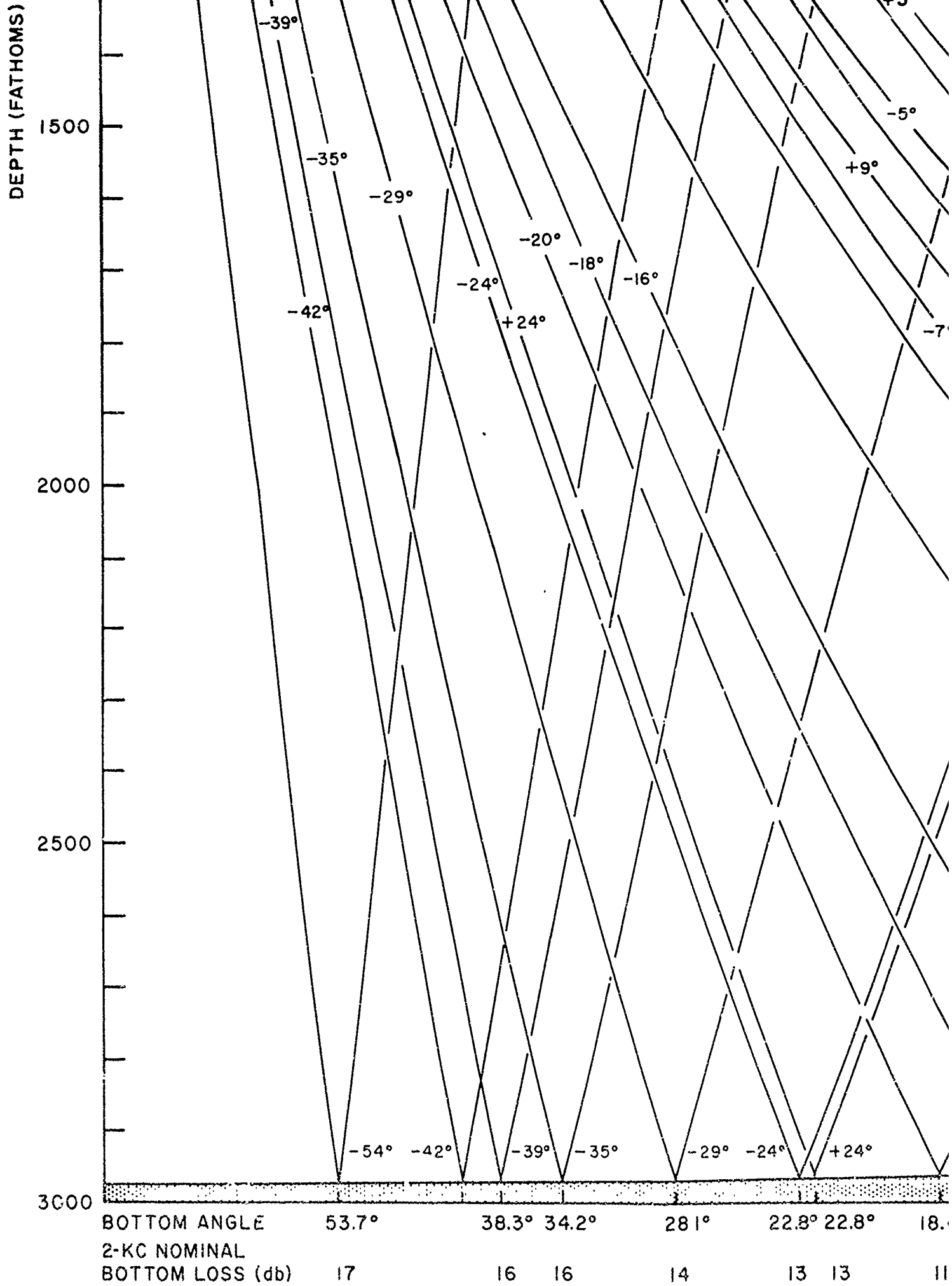
500

1000

1500

DEPTH (FATHOMS)





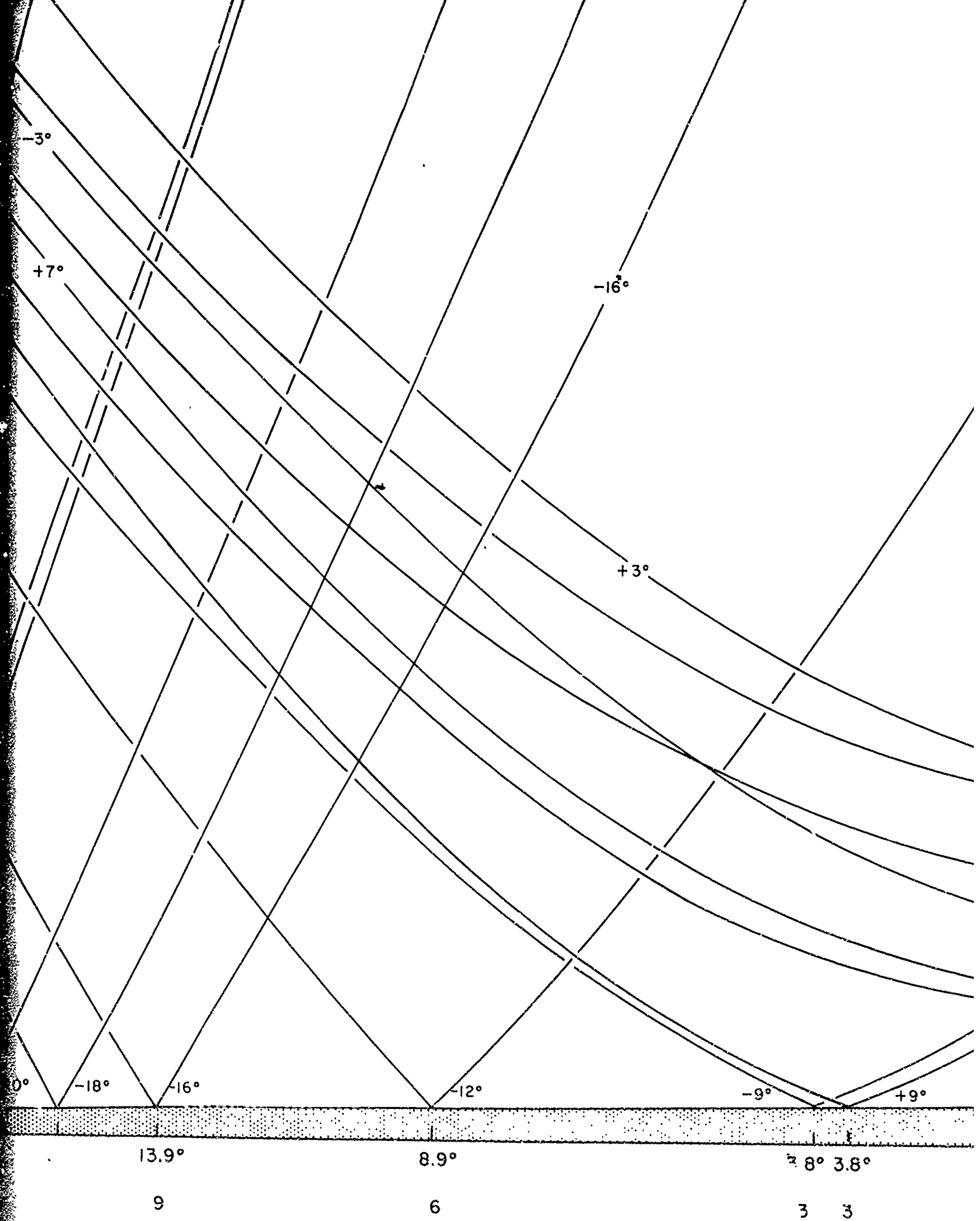
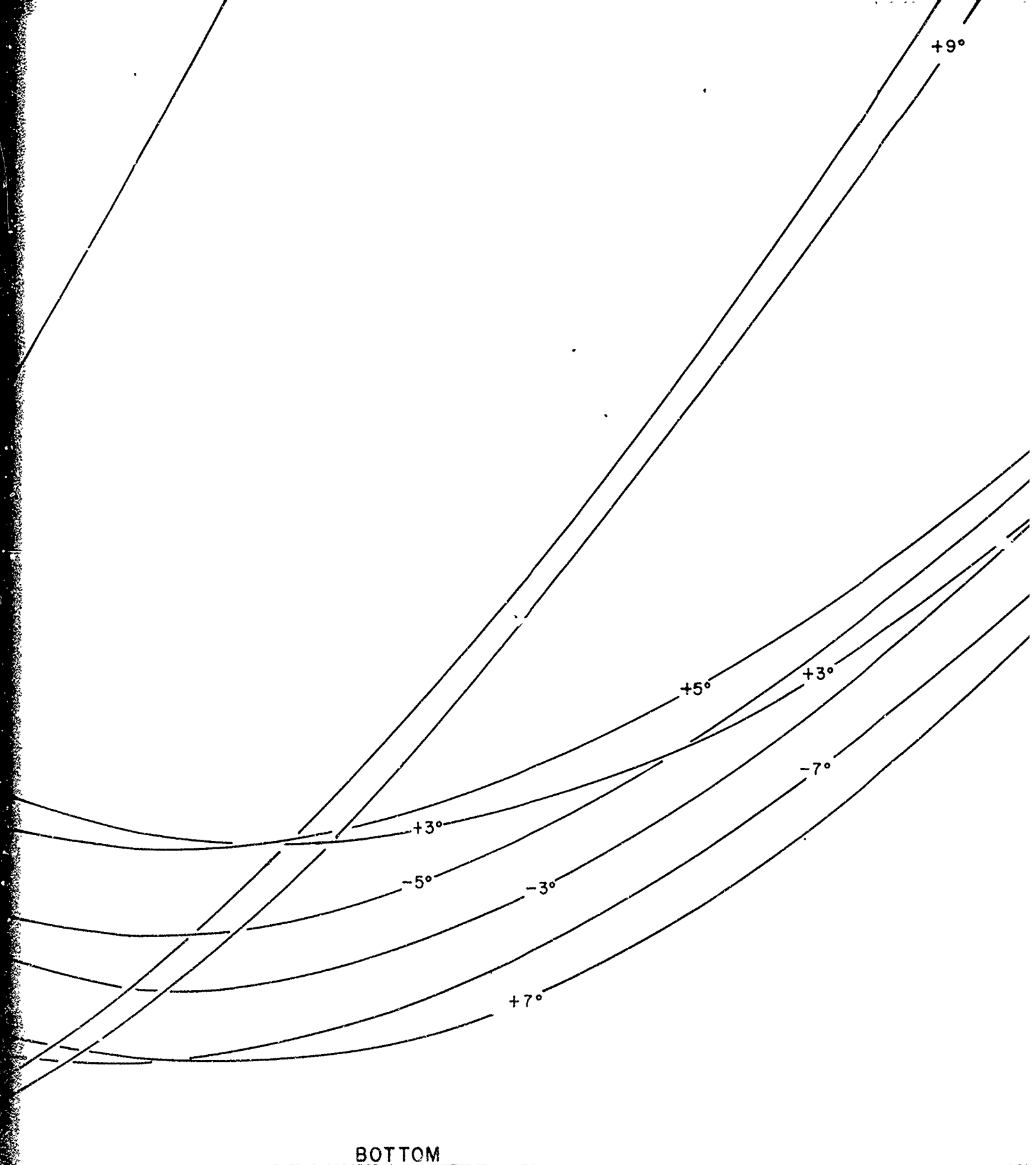


FIGURE 2 RAY DIAGRAM COMPUTED FROM TYPICAL



SOUND SPEED PROFILE FOR CROSS SECTION A-B SHOWN ON FIGURE 4 FOR JANUA



SOURCE DEPTH = 150 F

AND FEBRUARY

DEPTH (FATHOMS)

1500

2000

2500

3000

SOURCE DEPTH = 150 FEET

Equipment Tilt

Rays Included

0°

+ 9° to - 9°

-15° (Down)

- 6° to -24°

-30° (Down)

-21° to -39°

-45° (Down)

-36° to -54°

+15° (Up)

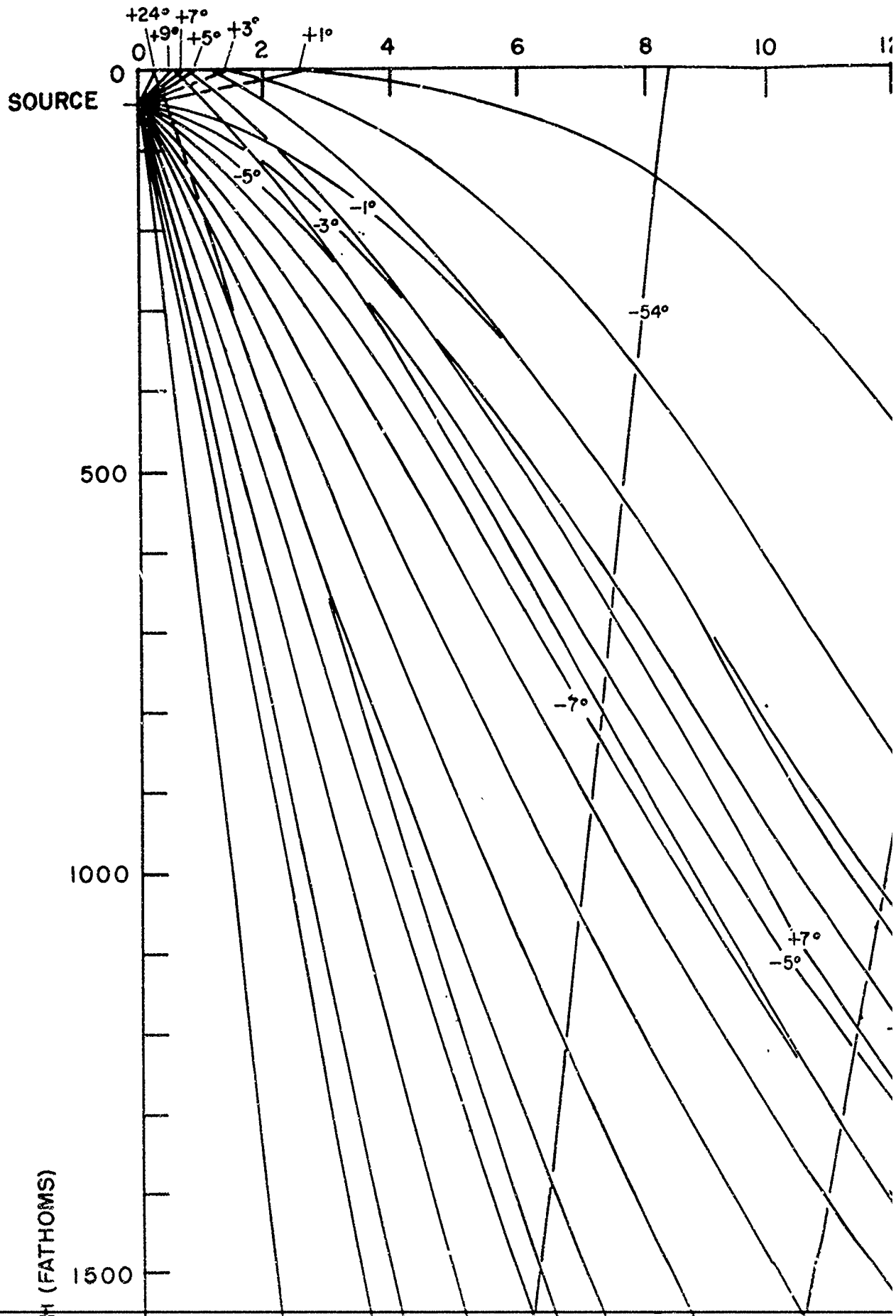
+ 6° to +24°

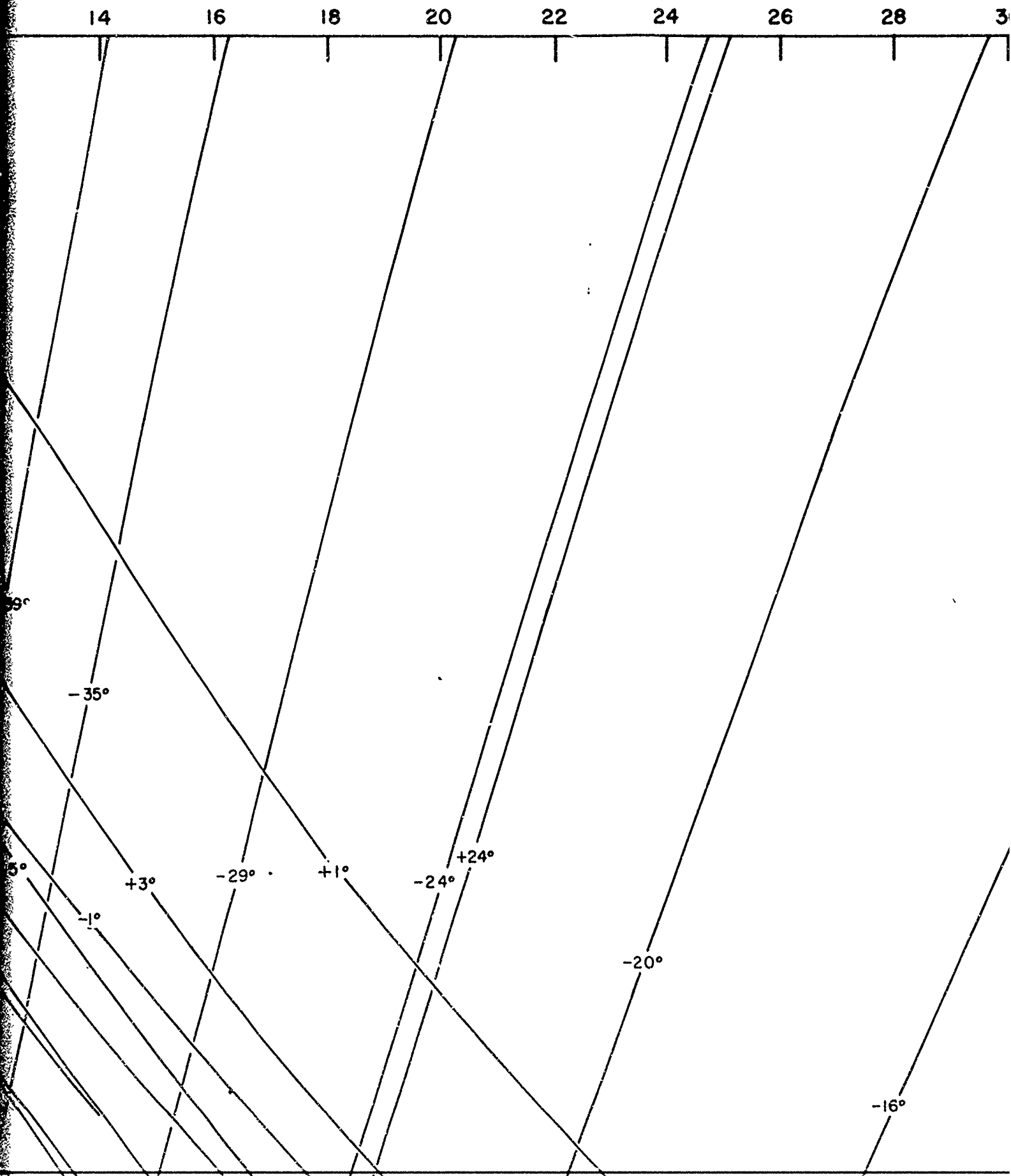
~~CONFIDENTIAL~~

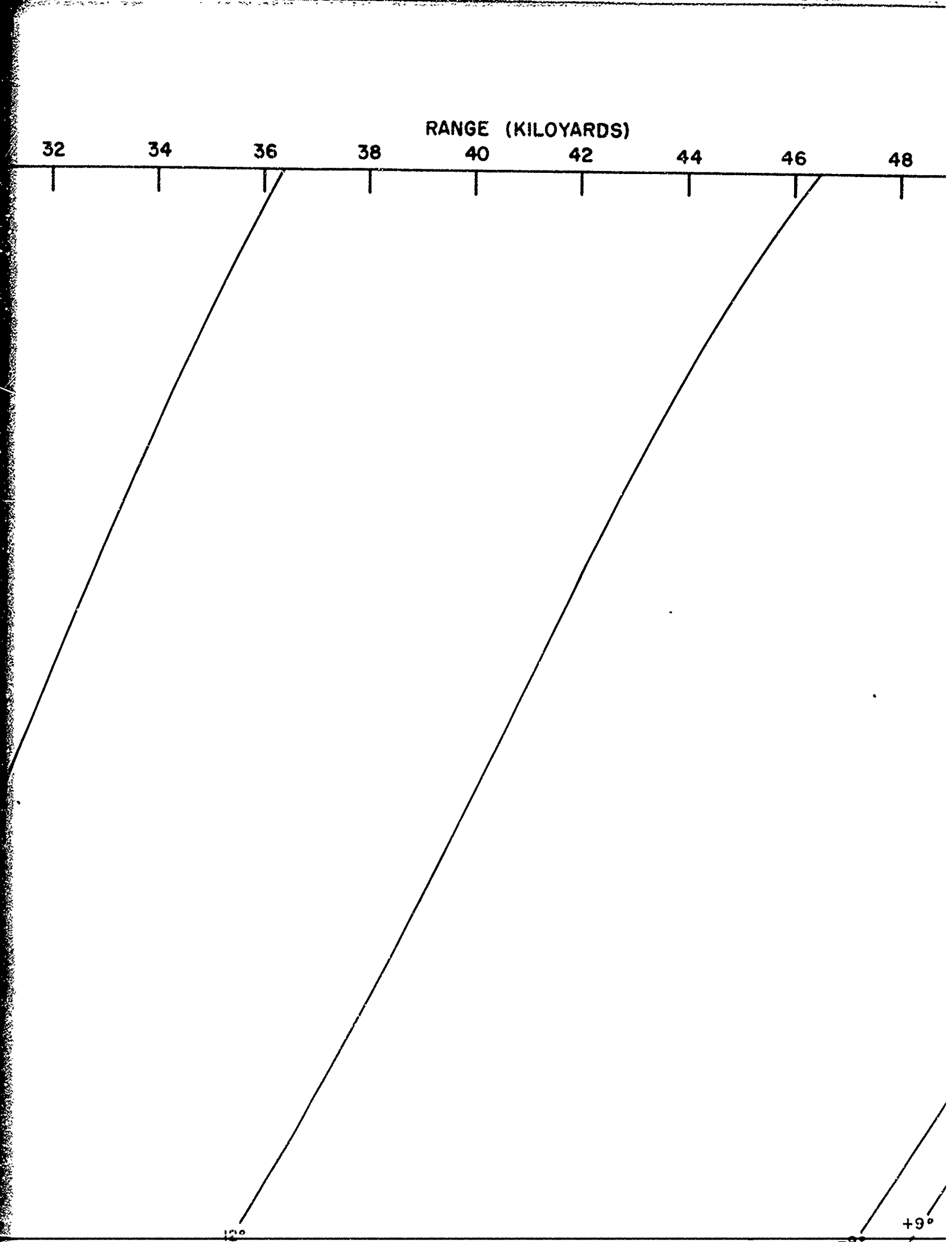


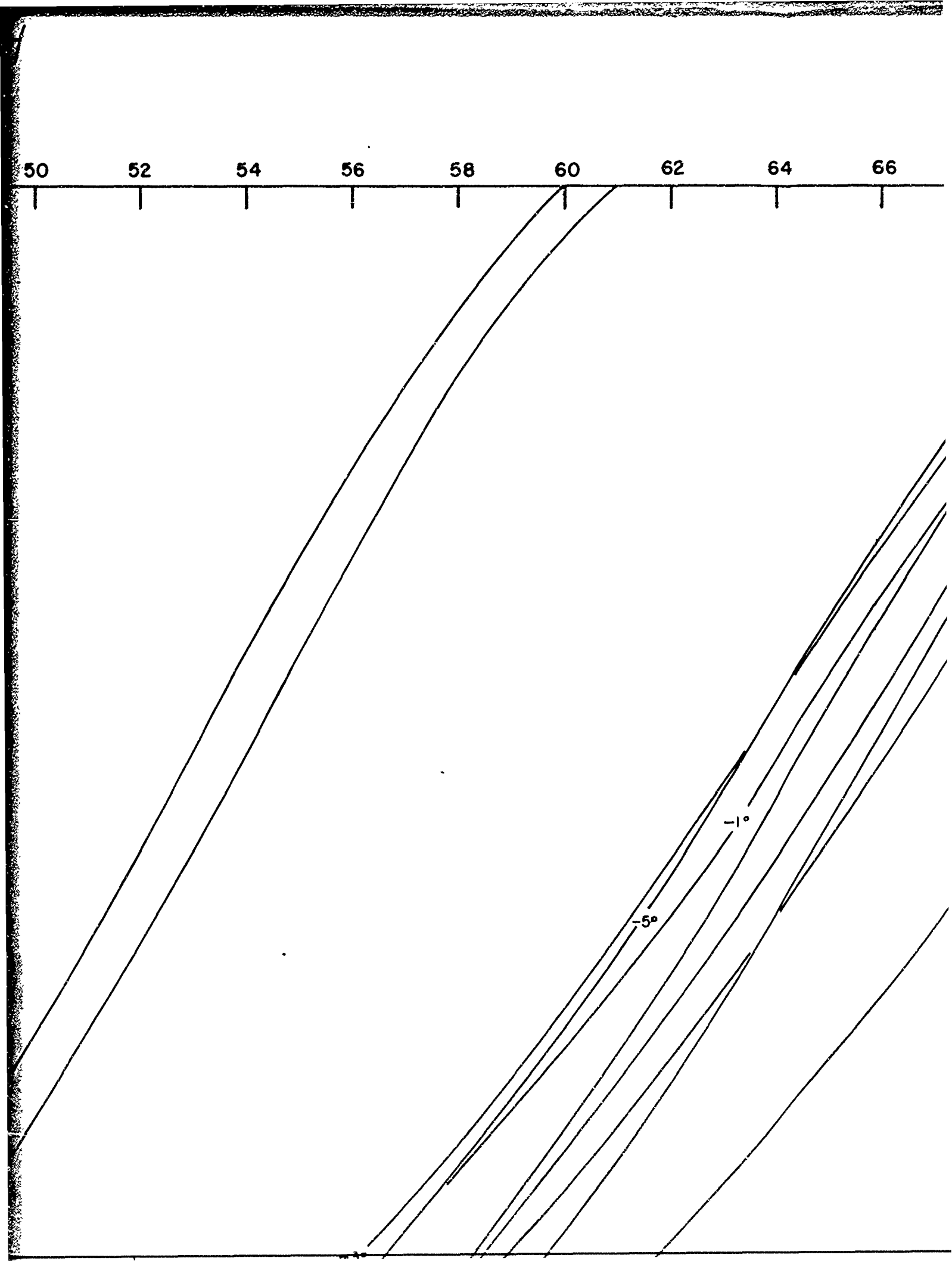
**CONFIDENTIAL**

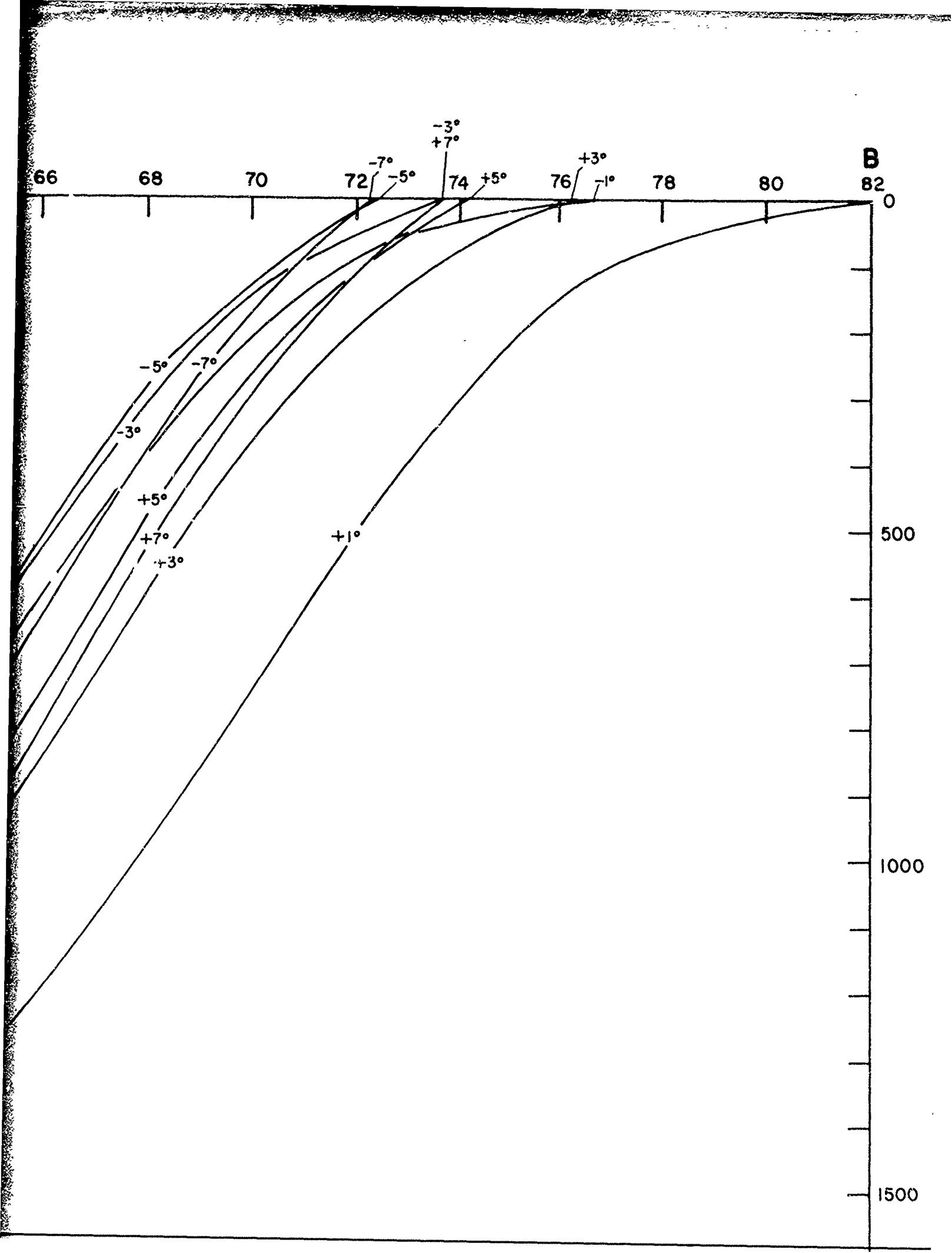
**A**











DEPTH (FATHOMS)

1500

2000

2500

3000

BOTTOM ANGLE

53.8°

38.4°

34.2°

28°

22.8°

22.8°

2-KC NOMINAL  
BOTTOM LOSS (db)

17

16

16

14

13 13

-54°

-39°

-35°

-29°

-24°

+24°

-20°

-16°

-1

-54°

-39°

-35°

-29°

-24°

+24°

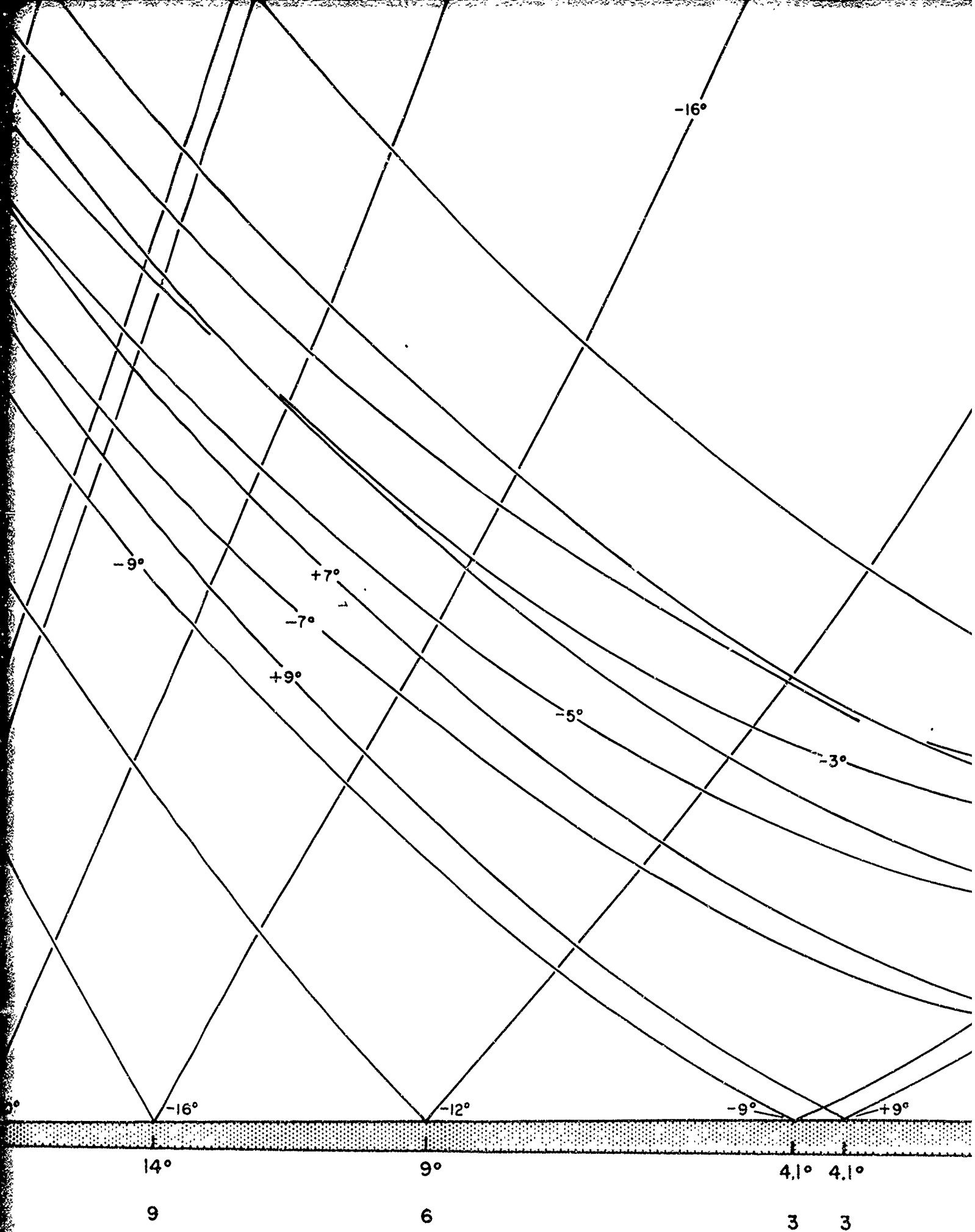
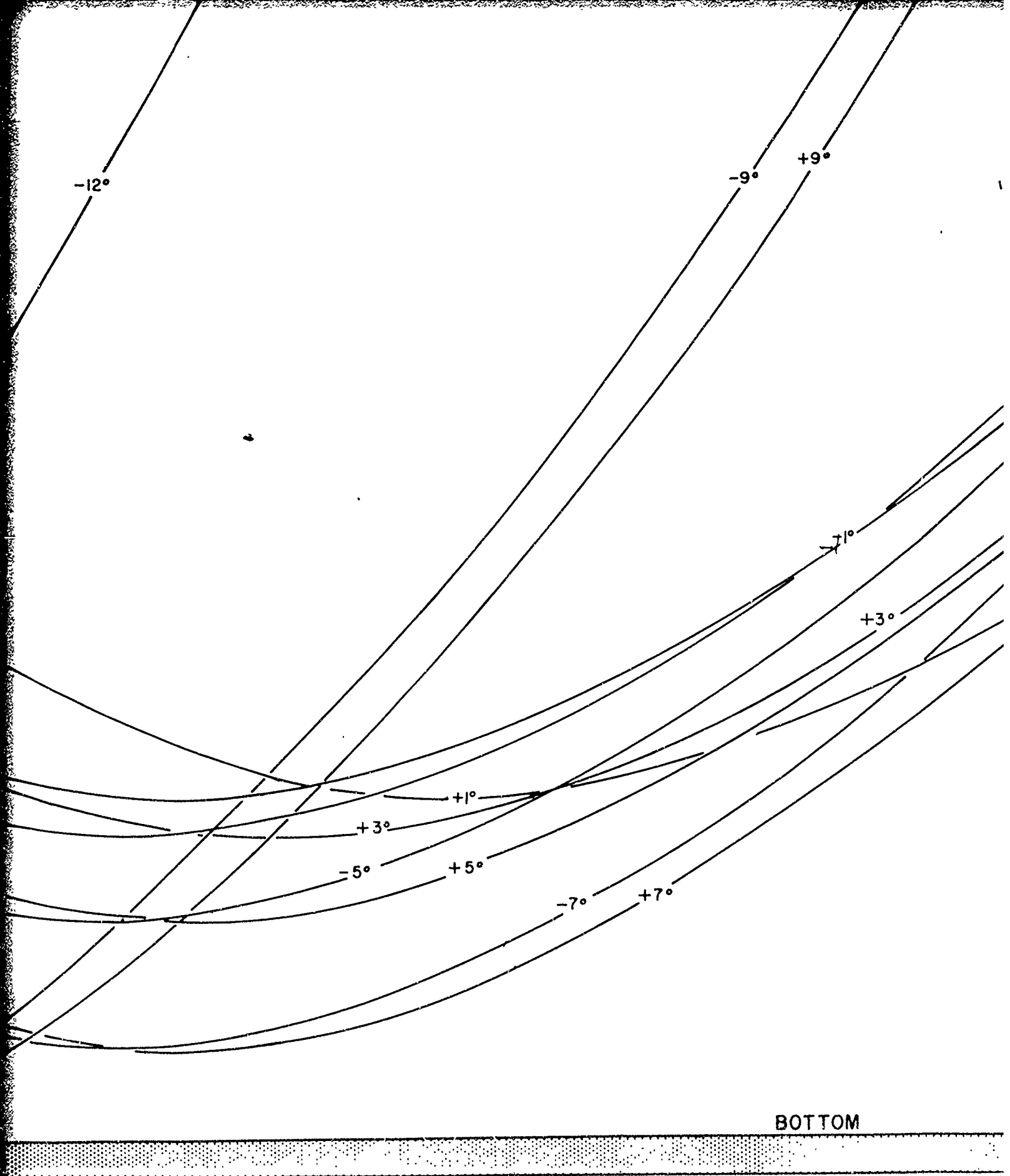
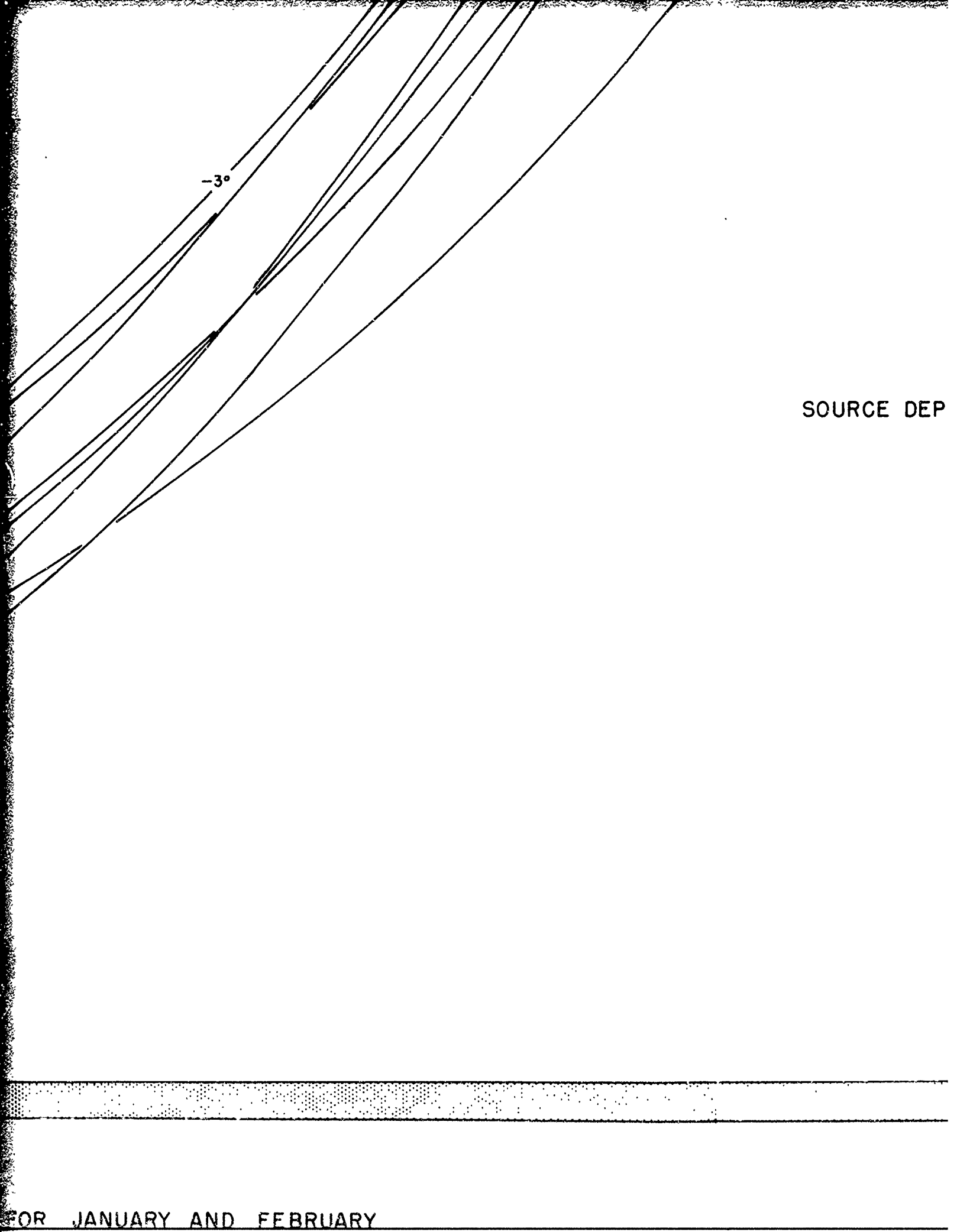


FIGURE 2a RAY DIAGRAM COMPUTED FROM TYP



AL SOUND SPEED PROFILE FOR CROSS SECTION A-B SHOWN ON FIGURE 4





-3°

SOURCE DEP

FOR JANUARY AND FEBRUARY

SOURCE DEPTH = 250 FEET

DEPTH (FATHOMS)

1500

2000

2500

3000

Equipment Tilt

Rays Included

0°	+ 9° to 9°
-15° (Down)	- 6° to -24°
-30° (Down)	-21° to -39°
-45° (Down)	-36° to -54°
+15° (Up)	+ 6° to +24°

CONFIDENTIAL

~~CONFIDENTIAL~~

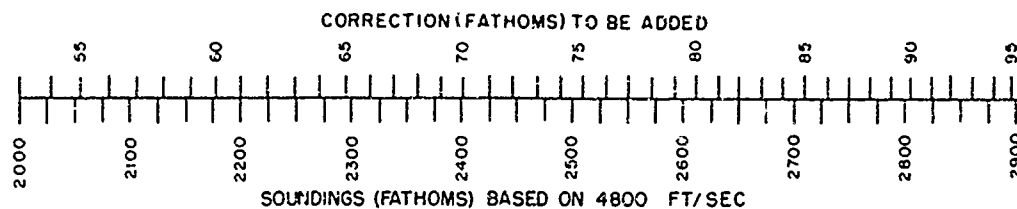


FIGURE 3 CORRECTION TO ECHO-SOUNDER DEPTH TO OBTAIN TRUE DEPTH

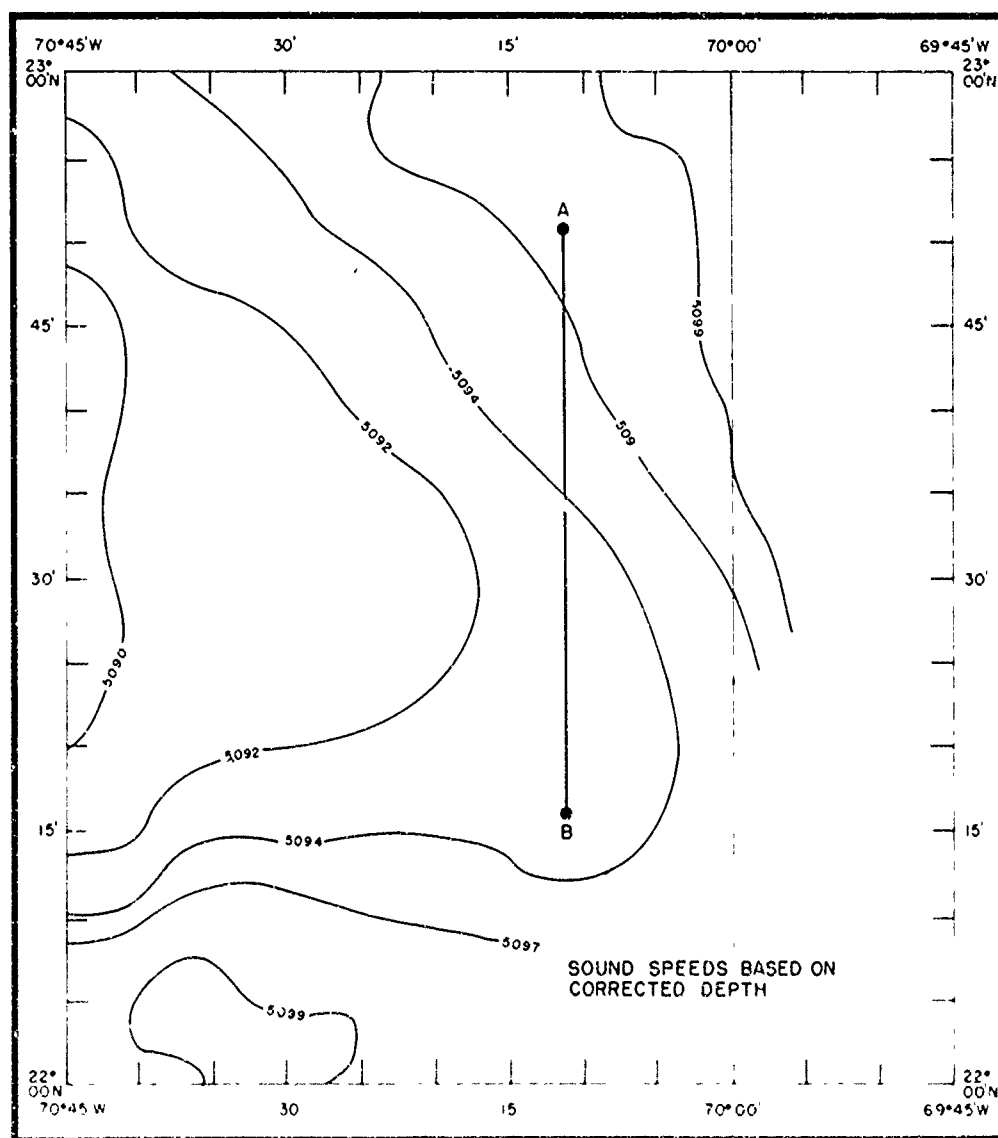
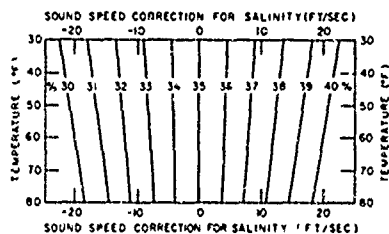
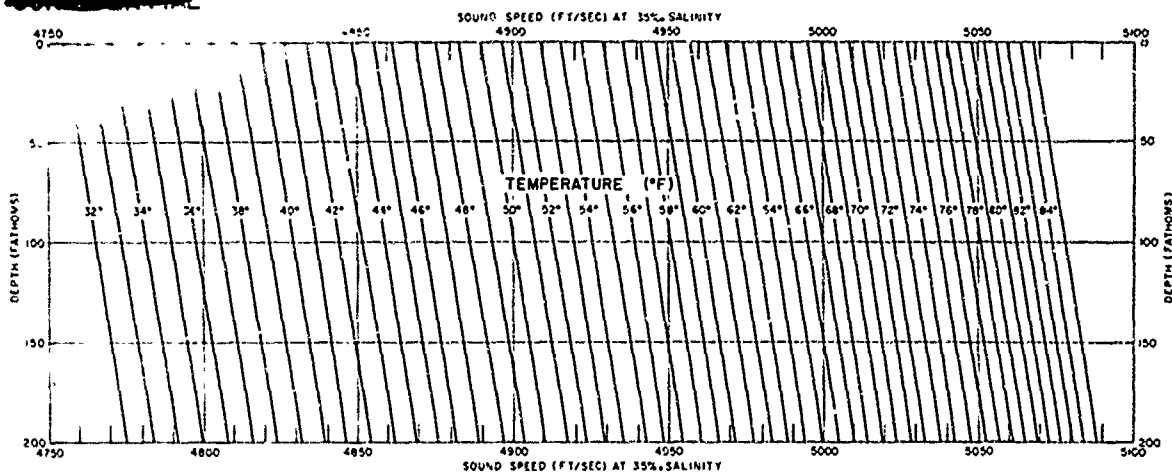


FIGURE 4 SOUND SPEED (FT/SEC) IN WATER AT BOTTOM

~~CONFIDENTIAL~~

0-113-63

~~CONFIDENTIAL~~



NORMAL SALINITY CORRECTION  
FOR THIS AREA AND SEASON  
IS +4 FT/SEC

FIGURE 5 SOUND SPEED NOMOGRAM

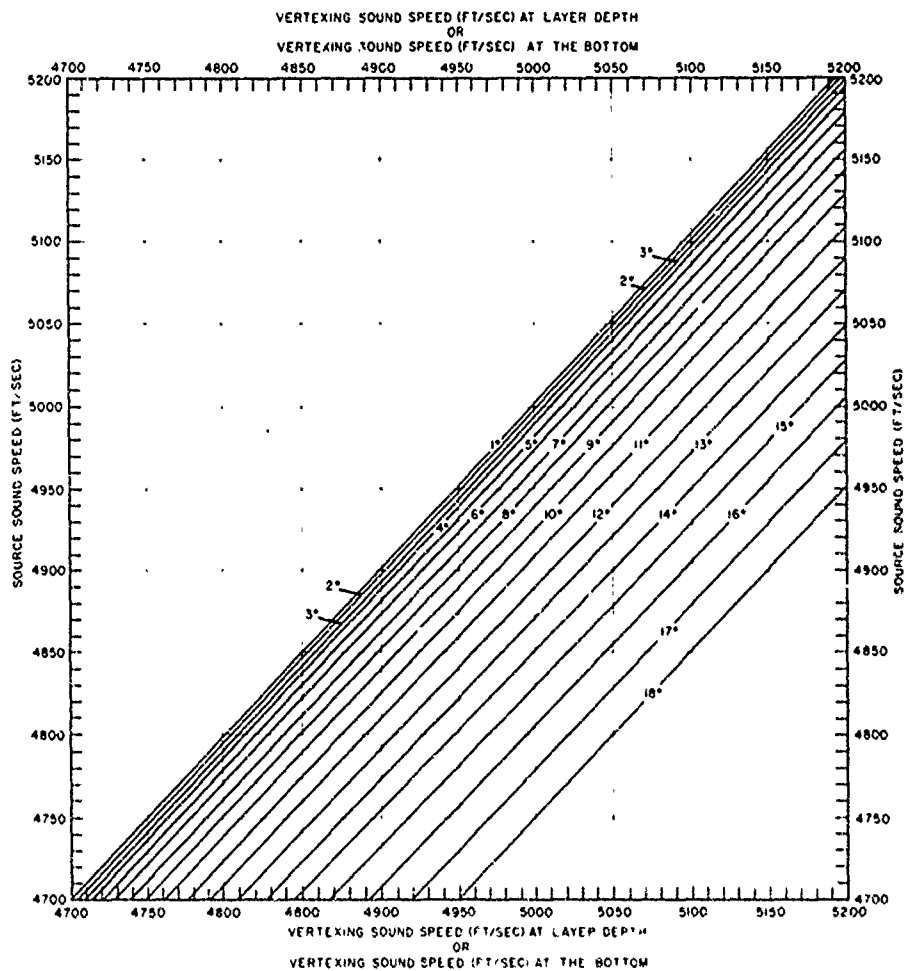


FIGURE 6 INCLINATION ANGLE VS SOURCE SOUND SPEED AND VERTEXING SOUND SPEED

0-113-63

~~CONFIDENTIAL~~

CONFIDENTIAL

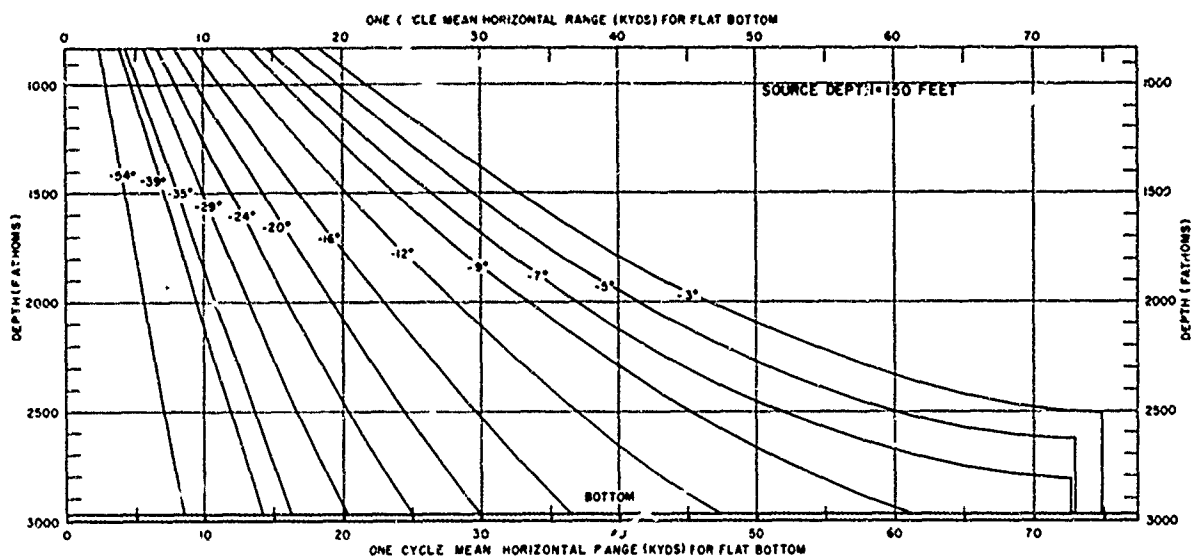


FIGURE 7 MEAN HORIZONTAL RANGE VS INITIAL ANGLE (DOWNWARD RAYS) AND WATER DEPTH FOR JANUARY AND FEBRUARY

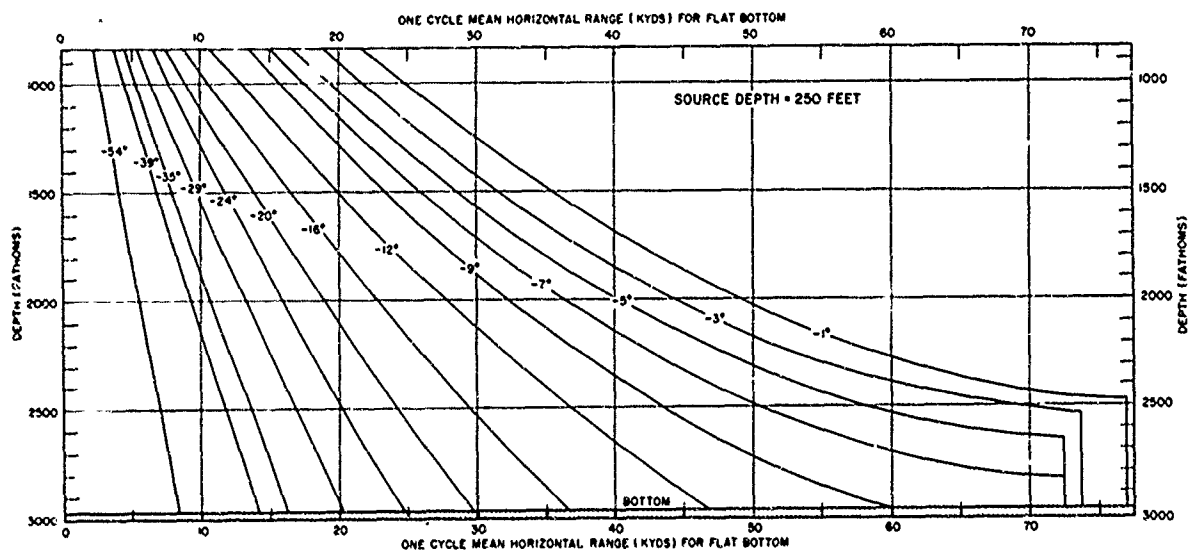


FIGURE 7A MEAN HORIZONTAL RANGE VS INITIAL ANGLE (DOWNWARD RAYS) AND WATER DEPTH FOR JANUARY AND FEBRUARY

0-113-63

CONFIDENTIAL

CONFIDENTIAL

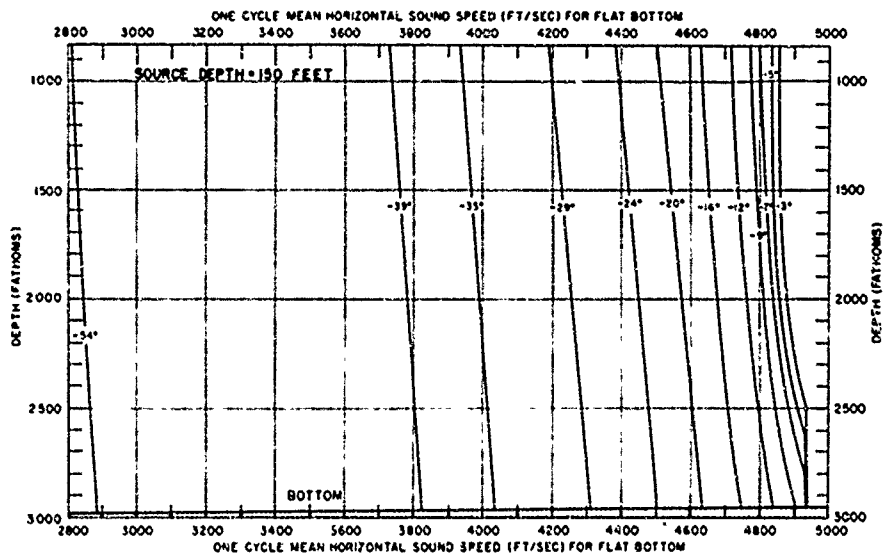


FIGURE 8 MEAN HORIZONTAL SOUND SPEED VS INITIAL ANGLE (DOWNWARD RAYS) AND WATER DEPTH FOR JANUARY AND FEBRUARY

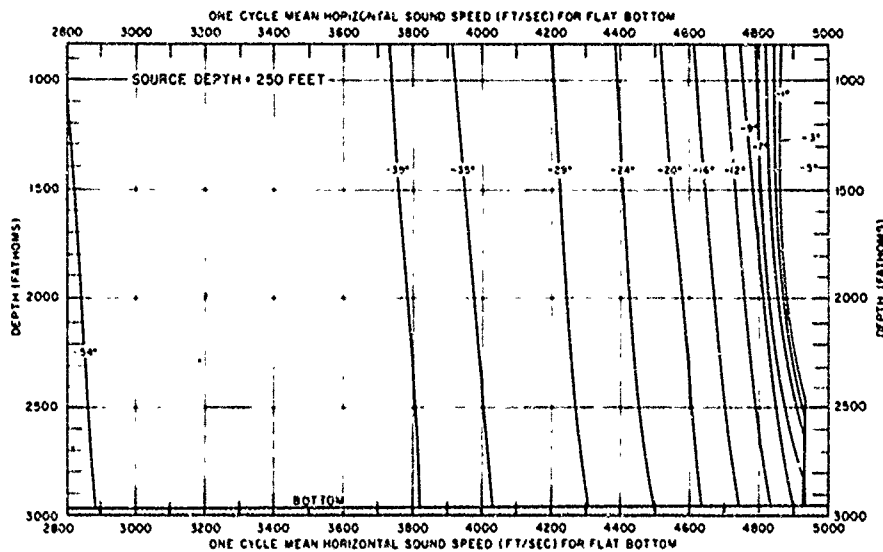


FIGURE 8A MEAN HORIZONTAL SOUND SPEED VS INITIAL ANGLE (DOWNWARD RAYS) AND WATER DEPTH FOR JANUARY AND FEBRUARY

0-113-63

CONFIDENTIAL

CONFIDENTIAL

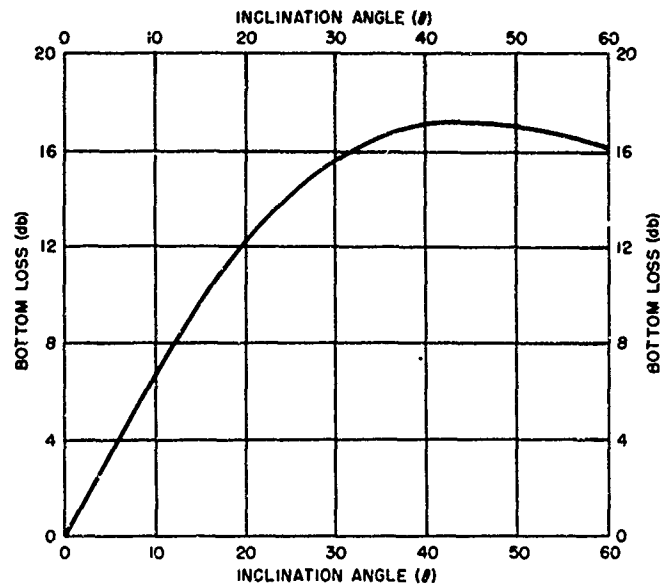


FIGURE 9 NOMINAL BOTTOM LOSS

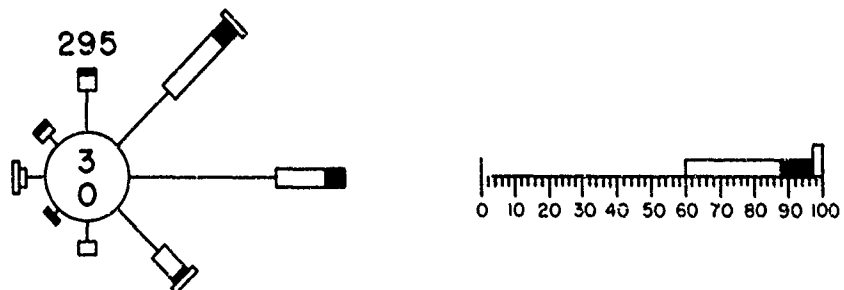
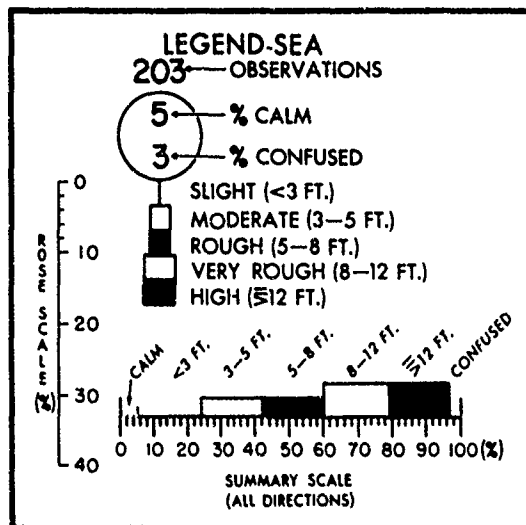


FIGURE 10 SEA STATE ROSE AND HISTOGRAM FOR JANUARY THROUGH MARCH

CONFIDENTIAL

5 0-113-63

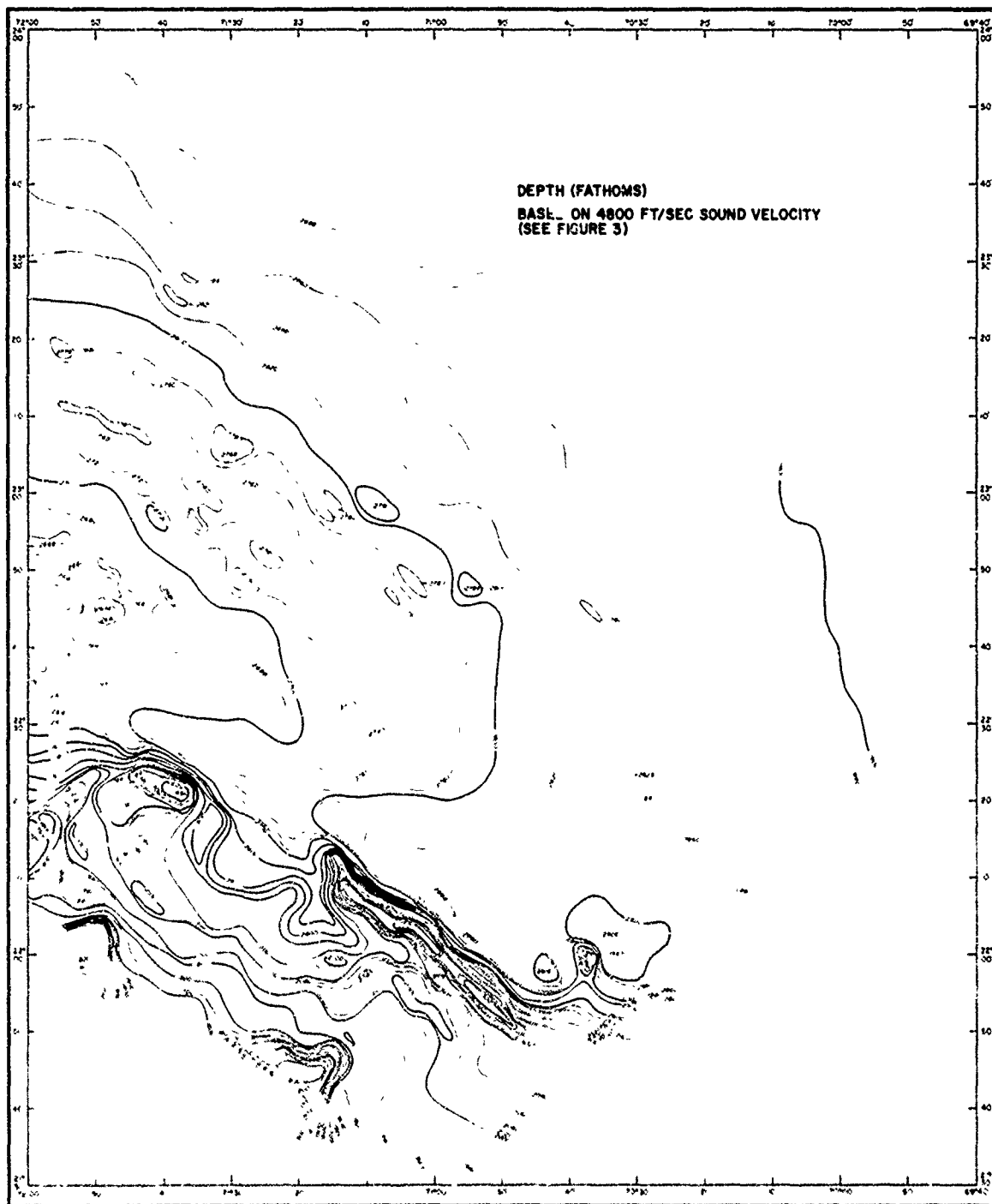


FIGURE II BATHYMETRY

0-113-63

CONFIDENTIAL



CONFIDENTIAL

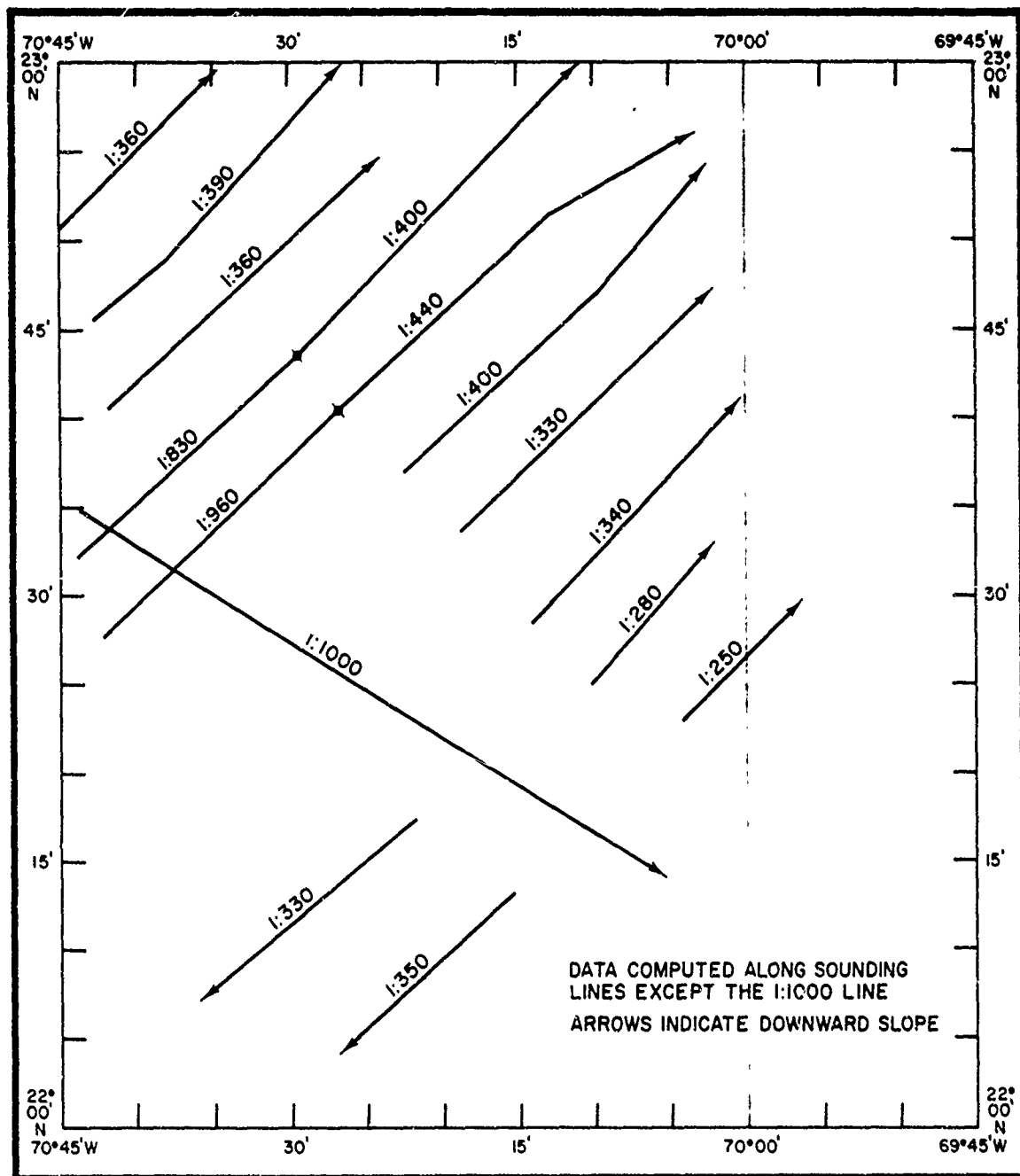


FIGURE 12 BOTTOM SLOPE GRADIENTS

0-113-63

CONFIDENTIAL

CONFIDENTIAL

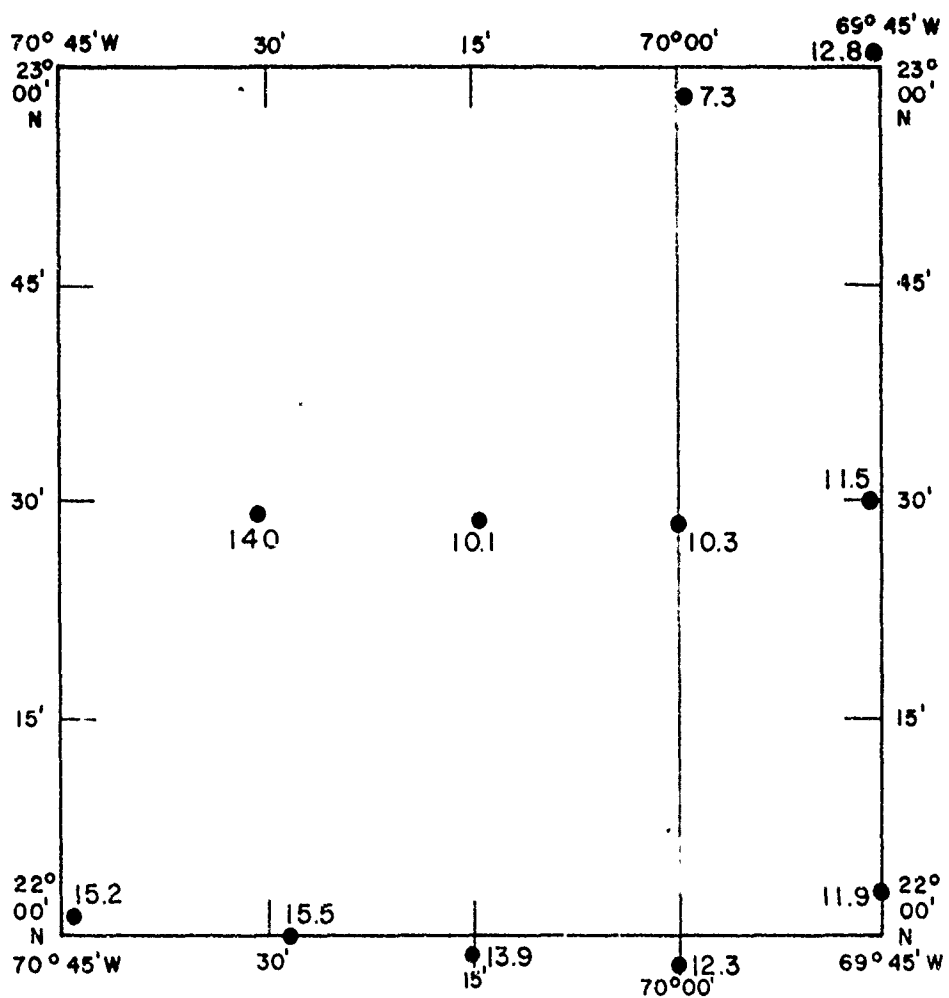


FIGURE 13 12-KC NORMAL INCIDENCE BOTTOM LOSS MEASUREMENTS (db)

AREA "J" 0-113-63

CONFIDENTIAL

**UNCLASSIFIED**  
**CONFIDENTIAL**

## TOPOGRAPHY

Bathymetric data for this area were collected during 2 separate surveys. One survey was centered at 22°31'N, 70°20'W, covered 1,520 square miles, and used LORAC positioning. The second survey was centered at 22°30'N, 70°10'W, covered 2,000 square miles, and used LORAN A for positioning. The second survey was conducted in 1962 by the USS SHELDRAKE but did not include the southeastern portion of the area.

The area is located on the outer edge of a broad ridge. Gradients have a minimum slope of 1:1000 and a maximum of 1:250. Examination of the 12-kc depth records revealed no penetration of the sound rays into the bottom and no evidence of minor irregularities in the bottom topography.

Bottom sediments consist of soft, sticky brown clay with particles less than 0.074 mm in size and containing as much as 15 % calcium carbonate in the form of globigerina tests.

## DEEP SCATTERING LAYER

The deep scattering layer (DSL) occurs throughout this area at depths of 250 to 275 fathoms. The intensity of the layer may vary from day to day.

Discontinuous shallow scattering layers (SSL) have been recorded using 14, 18, and 50 kc equipment. These layers, which have been recorded during all seasons, are nonmigratory and rather uniform in intensity.

## BIOLOGY

During January and February there are probably about 3 whales per 1,000 square miles. The occurrence of porpoises is sporadic and cannot be estimated. The number of schooling fishes in this area is unknown, but the area is seaward of the largest concentration of these fishes.

9 JAN-77B 0-113-63

**UNCLASSIFIED**  
**CONFIDENTIAL**